COURSE DESCRIPTION CARD - SYLLABUS

Course name
Hardware solutions used in the analysis of bioactive compounds [S2Bioinf2>RSAZB]

Course

Field of study
Bioinformatics

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge of the structure of atoms and molecules. The student should be able to self-educate and understand the need to complete his / her education and improve personal and professional competences.

Course objective

The aim of the course is to present the construction and hardware solutions used in combined techniques applied in the determination of bioactive compounds in biological samples.

Course-related learning outcomes

Knowledge:
The student knows and understands complex physicochemical and biochemical processes, including the principles of appropriate selection of materials, raw materials, equipment and devices for their

implementation and characterization of bioactive compounds.
The student knows chemistry issues useful for formulating and solving simple bioinformatics tasks, including basic concepts and laws of organic chemistry.
The student knows the basic principles of occupational health and safety and ergonomics while working in an analytical laboratory.

Skills:
The student is able to plan and perform research tasks, including engineering ones, under the supervision of a research supervisor, using analytical, simulation and experimental methods.
The student is able to plan and perform advanced measurements and laboratory experiments, including computer simulations, and interpret their results.
The student is able to prepare a presentation of research results in Polish and English and to discuss and debate them, both in the scientific community and in other environments.
The student is able to independently acquire knowledge and improve their qualifications.
The student is able to obtain information from literature, databases and other properly selected sources, also in English.

Social competences:
The student understands the need for self-education and improving their professional competences.
The student is ready to perform professional roles responsibly, taking into account maintaining the ethos of the profession, and to comply with the principles of professional ethics and act to comply with these principles.
The student is ready to determine priorities for the implementation of a task defined by themselves or others and to take action to implement tasks in an entrepreneurial manner.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Assessment of knowledge and skills from lectures demonstrated in a written exam of a problem-based nature.
Laboratory: tests for exercises and assessment of reports from the implemented project-exercises.

Programme content

The application of chromatographic techniques coupled to mass spectrometry in the analysis of bioactive compounds will be presented.

Course topics

Introduction to separation techniques (separation of sample components) and mass spectrometry (identification and determination of analytes).
Chromatographic separation techniques - comparison of liquid and gas chromatography - types of mobile and stationary phases and their influence on the separation of sample components.
Multidimentional chromatography - principle of operation and analytical benefits.
Mass spectra and their interpretation - spectra libraries.
Ionization methods - possibilities and effects of their application (EI, CI, ESI, APCI, MALDI, ICP).
Mass analyzers - comparison of the working method, obtained resolution and accuracy, tandem spectrometry.
Calibration of mass spectrometers.

Teaching methods

A lecture - a multimedia presentation containing the above program content.
Laboratory exercises:
- influence of ion source and solvent parameters on the mass spectrum of organic compounds in the LC-MS / MS technique,
- identification and determination of selected bioactive compounds in plant extracts,
- the influence of the column and ion source parameters on the quality of the GC-MS analysis,
- the use of MS spectral libraries in the identification of cellular metabolites.

Bibliography

Basic:
1. E. de Hoffmann, J. Charette, V. Stroobant „Spektrometria mas” Wydawnictwo NT , Warszawa1994
2. R. A.W. Johnstone, M. E. Rose „Spektrometria mas” Wydawnictwo PWN, Warszawa 2001
3. R. M. Silverstein, F. X. Webster, D. J. Kiemle ”Spektroskopowe metody identyfikacji związków organicznych, Wydawnictwo PWN, Warszawa 2007
4. A. S. Płaziak, K. Golankiewicz „Wprowadzenie do spektrometrii masowej związków organicznych” Wydawnictwo ISAT, Poznań 1992
5. P. Suder, A. Bodzoń-Kułakowska, J. Silberring „ Spektrometria Mas” Wydawnictwo AGH, Kraków 2001
6. W. Danikiewicz "Spektrometria mas. Podstawy i zastosowania" PWN, Warszawa 2020
7. Z. Witkiewicz, Podstawy chromatografii, WNT, Warszawa 1995

Additional:
1. J. Namieśnik, Z. Jamórgiewicz, M. Pilarczyk, L. Torres, Przygotowanie próbek środowiskowych do analizy, WNT Warszawa 2000
2.W. Szczepaniak, Metody instrumentalne w analizie chemicznej, PWN, Warszawa 2002
3. Scientific papers

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00